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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/781,920	12/30/96	FUKUNAGA	0756-1614

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EXAMINER	
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ART UNIT	PAPER NUMBER
1762	

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Please find below and/or attached an Office communication concerning this application or pr ceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 08/781,920	Applicant(s) Fukunaga et al
	Examiner M.L. Padgett	Group Art Unit 1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Peri d for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 9/23/98.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

Disp sition of Claims

☒ Claim(s) 24-58 is/are pending in the application.

Of the above claim(s)____ is/are withdrawn from consideration.

☐ Claim(s)____ is/are allowed.

☒ Claim(s) 24-58 is/are rejected.

☐ Claim(s)____ is/are objected to.

☐ Claim(s)____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on____ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number)____.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received:____.

Attachm nt(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 26

☐ Interview Summary, PTO-413

☐ Notice of References Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other____

Office Acti n Summary

(1) The request filed on 9/23/98 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 08/781,920 is acceptable and a CPA has been established. An action on the CPA follows.

(2) Claims 24-40, 47 and 56-58 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Since applicant's ignored the examiner's suggestion of simply deleting "the" in "the steps of" (preambles of independent claims 24 and 32) and instead deleted the entire phrase, now all first references to specific steps later in the claims and in the dependant claims lack proper antecedent basis, and are objected to. In claim 24, see lines 10-11, and 14-15; claim 25; claim 32, lines 14-15 and 18-19; and claim 33. The other independent claims 41 and 50 were appropriately amended in this respect.

Claim 38 is confusing and ambiguous, because as written it appears to contradict the independent claim 32 from which it depends by requiring a concentration of catalyst material where the source of the catalyst was explicitly excluded from being added. If the catalyst is NEVER added it cant be present where claim 38 apparently is try to require it to be. Clarification in the claims is needed. For purposes of examination and consistency a second concentration of zero will be considered to read on claim 38. Alternately, the catalyst material may be considered to migrate during subsequent processing such as the first heating where lateral

crystal growth proceeds, thus adding the catalyst via a process other than solution to the second potions, but clarity of intent is recommended. Claim 47 need analogous clarification.

In claim 56, line 6 "a crystallinity" is objected to as using the grammerically incorrect article, since crystallinity is NOT a singular object, but a quanitative one, it should be introduced with no article. Also, from the phrasing, the first heating must be assumed to produce incomplete crystallization (some of the film remained amorphous), or increased could not have been obtained.

Claims 31, 40, 49 and 55 are confusing and contradictory with respect to their independent claims, because one cannot promote further crystallization by melting whats already there!

(3) Claims 56-58 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for crystallization process using catalyst, as in the preceding claims, does not reasonably provide enablement for crystallization that need not involve catalyst. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. As specified in the abstract and Summary, applicant's invention is directed towards a crystallization process for amorphous Si that uses catalysts. On p. 9 of applicants remarks in the 9/23/98 amendment, applicants state that their intent is to delete the catalyst from the claimed steps, which is indirect contradiction to the stated objective of the specification. Applicants cite p. 18 of the specification for support, ie the last page of embodiment 1, which starts on p. 15, and

states in its first sentence that it uses a catalyst! Hence, while p. 18 teaches use of a pulsed excimer labor and multiple shots. All the examples that discuss crystallization also discuss use of a catalyst, such as Ni. The only non-Ni (or catalyst) sample to be found is sample No. 6 in Fig. 8, which caused crystallization only for comparison.

(4) Claims 24-58 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. As noted above, crystallization without catalyst as claimed in 56-58 is not taught in the original specification, hence is New Matter.

In independent claims 24, 32, 41 and 50, the claim of a second heating with an open ended temperature range is NEW MATTER, as is annealing the crystallized Si film in a hydrogen containing atmosphere. No disclosure of only a minimum required temperature was found, in fact temperature disclosure for the second heating step were either specific temperature, such as 550^{0}C for 4 hours in N_2 (embodiments 1,2,5 and 6), or well defined ranges of 450-750^{0}C, but when the substrate is glass limited to a maximum of 600^{0}C. Since the teachings in the specification stress the ability to use low temperature to crystallization due to the catalyst, the open ended temperature claim is contrary to the spirit of the disclosed invention, as well as unsupported.

There was NO disclosure found, of annealing the Si-film treated as claimed in a H-containing atmosphere. The closest disclosure to what was claimed, was in the last step of

producing a TFT device in embodiments, 3,4,5, 6 and 8 the otherwise completed device was annealed in H_2, usually at 350^{0}C and latm for about 30 min or 1-2 hr, but in all cases absolutely NONE of the previously deposited and treated Si film was exposed to the H_2 atmosphere , so this addition to the claim is NEW MATTER. Furthermore, even if the step was being applied to the correct product as disclosed, the annealing atmosphere is broader than that taught in the specification, since H_2 is only of one of a large set of gases that are hydrogen containing. Also, none of the embodiments that have the H_2 anneal of the TFT device, use the initial heat treatment before the irradiation, but instead use both heat and irradiate without first only heating to crystallize. Only embodiment 1, which does not give the steps for various layer in the device formation, teaches a first, separate heating step and definitely has NO H_2 annealing associated there with.

Claims 31, 40, 49 and 50 also appear to contain New Matter, because absolutely NO support for changing "fuses" to -- melts-- was found in the original specification. While what applicants intended by fused was unclear from the specification and context, there was NOTHING in the text to lead one to believe melting had taken place. Quite the opposite in fact, since one cannot improve or increase or promote further crystallization of a solid phase by making it liquid, which only might provide condition to enable recrystallization, ie making crystals go away can't increase, etc those same crystals.

(5) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

(6) Claims 24-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohtani et al (5,543,352) in view of Zhang et al (5,529,937) or visa versa, optionally in view of Liu et al (826) or Zhang et al (291).

Claims 24-58 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 5,543,352 ~~in view of~~ to Ohtani et al, in view of Zhang et al (937), optionally in view of Liu et al (826) or Zhang et al (291)

Ohtani et al claims (hence teaches) all aspects of applicant's claims, except the second thermal heating step; the formation of a transistor with channels (claims 41-49); the claimed melting (previous fusing) step whose meaning is not particularly clear or supported, but may be considered covered by teachings of light or laser light used in the same fashion; and the H_2

annealing step which is also unsupported by applicants disclosure. The specification of Ohtani et al (ie for the 103 rejection) explicitly teaches the use of excimer lasers, which are inherently pulsed lasers for use in the laser irradiation step of the crystallization, hence covering that aspect of new claim 56. See col. 7, lines 10-15 in Ex. 1; col. 8, lines 1-8 in Ex. 2; col. 13, lines 16-28 in Ex. 5 and col. 15, lines 1-8 in Ex. 6 for use of various excimer lasers (KrF and XeC1) as claimed. It is further noted that Ex. 3 on col. 10, lines 38-45; Ex. 4 (called 5) in col. 12, lines 55-60; Ex 5 in col. 14, lines 40-42 and Ex. 6 on col. 16, lines 5-8 teach annealing the final TFT devices produced in a hydrogen atmosphere, under conditions and circumstances as taught in applicant's specification. Granted, to apply this step to the claims one has to ignore its context in the same fashion applicants did to amend the claims, however in light of applicants' specification this step is clearly covered for purposes of the 103 rejection. With respect to the judicial double patenting and in light of the specification, it would have been obvious to preform conventional annealing procedures as claimed, to some unspecified final product, depending on what that product was and the intervening steps that produced it, that may have produced various damage that needed correcting or require particular final surface properties, etc. At present the claims lack context for the H_2 annealing as disclosed in the specification to be meaningful (or supported).

The patent to Zhang et al ('937) teaches and claims a very similar process with many overlapping steps, however it also teaches heating of the silicon film before, during and possibly after the irradiation step. Particularly see claim 56, or col. 8, lines 12-23, or col. 15, lines 18-51 and Figure 5, where 3 periods of heating are discussed in relationship to the light irradiation step,

such that the third step with 200-500^{0}C corresponds to applicants claimed second heating, with overlapping temperature ranges. The irradiation step in Zhang et al (937) may use either IR or laser light to promote further crystallization (col. 7, lines 60-67; col. 9, lines 46-59; col. 12, lines 20-24), but the specific type of laser used at that step is not specified, however later laser anneal steps (after doping) applied to the Si film use excimer lasers (ie pulsed), hence it would have been obvious to one of ordinary skill in the art to use the same types of lasers in the early step or in Ohtani et al's laser irradiating claims, because in both instances lasers are used to effect the crystallization of the silicon film in analogous fashions. See col. 10, lines 42-51 and col. 16, lines 49-58 for KrF lasers and parameters used for annealing the Si film. Zhang et al (937)'s claims, such as 12, appear to be after or possibly during the irradiation, but have unclear temporal language. It would have been obvious to one of ordinary skill in the art to apply such heating in the Ohtani et al reference due to the similarities of the processes and the taught benefit of reducing defects and dangling bonds. Zhang et al particularly teaches the use of nitrogen in the initial heating to crystallize and after irradiation H_2 ambient instead of N_2 as claimed by applicants present claims 25, 33, 42 and 51 in order to neutralize dangling bonds (col. 7, lines 52-59; col. 8, lines 19-30; col. 9, lines 15-59 and col. 11, lines 11-16, etc), however inert atmospheres would also have been expected to be effective as they are conventionally used for annealing procedures, hence would have been expected to have been effective especially considering the initial use of N_2 when heating to crystallize. Alternately Zhang et al (291) or Liu et al (826) teaches the use of Ar or other inert atmospheres for Ni or Pd-catalyzed annealing

procedures of Si films at temperatures within the presently claimed range although slightly higher than Zhang et al (937) third temperatures (col. 4, lines 20-48 and Ex. 2). Lui et al thus provides cumulative evidence that inert atmospheres, hence N_2 would have been expected to be effective for the annealing of Ohtani et al in view of Zhang et al (937), where the particular temperature would have been optimized for the atmosphere used by routine experimentation, with guidance from the temperature teachings of Zhang et al (937) and Lui et al.

The use of H_z gas when annealing after irradiation in Zhang et al (937) would have made a subsequent H-anneal step in Ohtani et al further obvious due to the explicit teaching on the effects on any dangling bonds that may remain. Note that this concept matches applicants' amended claims, but in Zhang et al (737) is used at a totally different time than in applicant's specification.

Zhang et al (937) also teaches use of their products, as claimed, for producing channel forming areas in transistor devices (col. 15, lines 52-59), hence use of the analogous features in an Ohtani et al product for such would have been obvious.

As noted above, claims 25, 33, 42 and 57 differ by requiring their atmosphere to be N_2, however Zhang et al (291) shows that for annealing semiconductors using heat, that N_2 is known to be an inactive atmosphere, hence obvious in view of the annealing procedures of the primary references which are also a heat treating α-Si to cause crystallization. In Zhang et al (291) see abstract and claims, especially 1-10.

In Zhang et al (937) for further relevant teaching see abstract; Fig. 1 (etc); col. 4, lines 1-32 and 59-col. 5, line 20 and 58-col. 6, line 52, noting both thermal and radiation treatment appear to be taught to convert the amorphous area entirely to crystalline with col. 5, lines 5-10, discussing heating to 600°C in conjunction with using laser light. Particularly see col. 9, lines 15-45 for α-Si with Ni to promote crystallization where first heating at 550°C in N_2 or Ar for 4 hrs is taught, then lines 46-59 where laser light is taught to "further promote" crystallization, which is consistent with applicant's claimed limitations. Lines 55-59 discuss the effect on dangling bonds and reduction of defects. Col. 9, lines 60-67 give the next step which includes heating of the entire substrate from 300°-550°C, hence will also inherently fulfill the claimed thermal annealing which can also be a posttreatment step. Furthermore, in the making of device, after ion implanting (col. 10, lines 20-41), laser annealing is preformed again (col. 10, lines 42-67) and then it is taught that it is important that dangling bonds caused in the process of light annealing... are neutralized by heating them at a temperature of from 250° to 400°C in the atmosphere of hydrogen in a later process" (col. 11, lines 12-16), hence cumulatively showing this concept. Note that Zhang's process involves patterns after the annealing, which is consistent with the concepts of claims 41 and its dependents.

(7) Applicant's arguments filed 9/23/98 and discussed above have been fully considered but they are not persuasive.

Applicant's might find it useful to actually check their amendments for support before submitting them, especially the context and breath of support in the specification, especially in

view of the prosecution history! It is noted that newly supplied Tanaka (364) and Ohtani et al (291) have equivalent teachings to (352), as does the specification of Miyanaga et al (829).

(8) The disclosure is objected to because of the following informalities: Proof reading to double check figure and reference number correspondence is needed. During checking for support it was noticed that p. 33 incorrectly refers to Fig. 6C and in embodiment 8/Figure 9 series, ref. # 904 does not appear to be identified.

Appropriate correction is required.

(9) Any inquiry concerning this communication should be directed to M. L. Padgett at telephone number (703) 308-2336 and Fax # (703) 305-5408 (official) ; 305-3599 (afterfinal); and 305-6357 .

M. L. Padgett/vr

12-18-98

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